JOURNAL OF BALTIC SCIENCE EDUCATION

ISSN 1648-3898 /Print/
ISSN 2538-7138 /Online/

BASIC INQUIRY AND INTEGRATED SCIENCE PROCESS SKILLS IN DIGITAL-RELATED EXPERIMENTS WITHIN PHYSICS TEXTBOOKS OF SOUTH KOREA, THE UNITED KINGDOM, AND INDONESIA

Ni Wayan Rai Utari Dewi,
Minchul Kim

Abstract. *Technological development, particularly in experimental, is now embedded in physics textbooks. Therefore, this study analyzed how the basic inquiry and the integrated science process skills in digital-related experiments are distributed within physics textbooks of South Korea, the United Kingdom, and Indonesia. A descriptive qualitative content analysis was conducted by analyzing physics textbooks from these countries. The samples included six physics textbooks, two from each country. The findings indicate that the most frequently used digital-related experiment tool was the video recorder in South Korea, the computer in the United Kingdom, and the virtual (simulation) experiment in Indonesia. The distribution of basic inquiry skills from these countries predominantly emphasizes 'observing' and 'measuring', while other skills are only minimally incorporated. However, the 'classifying' and 'predicting' were not found in any textbooks. Furthermore, the distribution of integrated science process skills shows that 'experimenting' skills are used most frequently, while the other skills are only minimally incorporated. However, 'formulating hypotheses' was not found in any textbooks. Therefore, this study strongly emphasizes the digital-based experiments, which highlight the optimization of basic inquiry and integrated science process skills distribution. This study can be used as a reference in developing educational policy or curriculum on a global scale.*

Keywords: *basic inquiry skills, integrated science process skills, digital experiment*

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Introduction

Technology has had a profound impact worldwide in this era of globalization. These days, a popular topic, Artificial Intelligence (AI), is gaining much attention because of its convenience. This discovery contributes to various fields in this digital era. It has been proved that technology influences the life aspect of humans. Digitalization has a significant role in many fields, particularly the education field. In the education field, the utilization of technology is commonly adopted by teachers and students. For instance, PowerPoint is used to present the materials of physics material in the school, which also constructs learning engagement with students. Moreover, in this era, students are highly skilled in managing technology, which aids their study. In the education environment, the learning process is more entertaining when technology is integrated (Ghory & Ghafory, 2021). This study has shown that the integration of technology into the learning process is interesting for students. Besides that, visualizing abstract scientific learning and phenomena can be implemented using digital technology, which assists students in understanding the contextual meaning (Walan, 2020). Moreover, regarding the science curriculum, awareness of the complex relationship between technology, science, environment, and society becomes a major value of learning goals (Hodson, 2020). Furthermore, Science, Technology, and Society (STS) in education have several goals, including providing science and technology literacy and equipping the future generation with the ability to master digital tools and information related to science and technology in a global society (Kumar & Chubin, 2000). This highlights the importance of technology integration within the learning stages in the school. Furthermore, in the current labor market demand, whether in research or private enterprises, the ability to operate technology has become a new requirement in physics education (Lahme et al., 2023).

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

According to development experts and policymakers, most of them agree that establishing the science and technology capacity assists developing countries in generating the essential social networks for development, particularly in the globalization era (Wagner et al., 2001). The United Kingdom and South Korea are included as scientifically advanced countries on a science and technology composite index, which means these countries have greater science and technology capacity than the international mean (Wagner et al., 2001). In contrast, Indonesia is considered a scientifically developing country on a science and technology composite index, which has an overall scientific capacity below the world average (Wagner et al., 2001). It is consistent with the result of the Programme for International Student Assessment (PISA) in 2022, which reveals that the mean score of science performance in South Korea and the United Kingdom reached a mean score above the Organization for Economic Co-operation and Development (OECD) average, while Indonesia positioned below the OECD average. The mean score in South Korean students' science performance is categorized as a high score among eastern regions, and the United Kingdom also has a high score above the OECD average among western regions. These countries are classified as developed in terms of science development. In contrast, Indonesia, as a developing country, falls behind. This gap in the performance of science and its relationship with the development of a country could be grounded in the aspect of how these countries embedded the connection between science and technology in the educational context, especially in their school textbooks. One of the subjects of science that makes a major impact is physics. The disparity of this gap can be seen in the way each country delivered the materials of physics through their physics textbooks.

Every country has created its distinct educational system, resulting in varied approaches to learning experience designs, including the coverage of experimental design within textbooks (Huang et al., 2022). The utilization of technology can be implemented or incorporated into physics textbooks. Textbooks have a pivotal role in student learning instruction and as a guiding book for teachers to conduct the learning process. Students, who are provided with textbooks, not only rely on the teacher for teaching, but they can also study independently, following the steps within the textbooks. The presence of digital-related experiment tools can assist study during self-regulated learning. In addition, these digital-related experiments provide the same opportunity in the learning process, even though their school lacks laboratory tools or has to avoid dangerous equipment. Digital representations of various forms are tried out to enhance students' sense-making to fill the void between lab experiments and the laws of science (Kluge, 2014). Digital-related experiment tools include virtual simulations, interactive software, and online experiments, which allow students to conduct experiments and interact with concepts in a safe and controlled environment. Using these digital-related experiments, students can engage in real-world situations that involve experiments related to laboratory instruments.

In the past, students learned through analog experiments that involved direct basic inquiry and integrated science process skills. This process trained students to use scientific instruments directly and fostered the development of science process skills. However, these analog tools have now been replaced by digital instruments, which may also influence students' science process skills. When using digital tools, it is unclear whether students' ability to measure directly is still being developed, as digital tools often display results automatically without requiring the same measurement process as analog tools. An initial step in evaluating science process skills within digital experiments is to conduct an analysis of physics textbooks. Harlen (1999) has emphasized that science process skills are essential for developing students' scientific reasoning and should be explicitly included in the teaching and assessment of these skills through educational materials such as textbooks. Chiappetta and Koballa (2010) have explained that science textbooks should include inquiry-based activities and experiments that encourage students to apply the science process skills. However, the effectiveness of developing science process skills can vary depending on how well the digital components are aligned with the intended learning objectives. In the case of integrating technology into physics textbooks, especially in experimental activities, science process skills need to be embedded to enhance students' scientific skills, ensuring that they can conduct experiments as effectively as they would in hands-on experiments without technological assistance. Science process skills are divided into two categories: basic inquiry skills and integrated science process skills (Sermsirikarnjana et al., 2017). The presence of basic inquiry skills and integrated science process skills in physics textbooks that discuss digital-related experiments is a crucial aspect of fostering students' scientific abilities. Analyzing whether the distribution of basic inquiry skills and integrated science process skills has been allocated in these digital-related experiments is essential. Many studies analyzed the science process skills within textbooks. However, there are limited studies regarding how basic inquiry and integrated science process skills in digital-related experiments are embedded within physics textbooks across different educational systems. Therefore, examining the basic inquiry and integrated science process skills in digital-related experiment tools in upper-secondary physics textbooks in South Korea, the United Kingdom, and Indonesia is necessary.

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Research Aim and Research Questions

The purpose of this study was to investigate how digital-related experiments are distributed within physics textbooks in South Korea, the United Kingdom, and Indonesia. This research analyzed how basic inquiry and integrated science process skills in digital-related experiments are distributed within physics textbooks of South Korea, the United Kingdom, and Indonesia.

The research questions in this study were formulated as follows.

1) How are the digital-related experiments distributed in the upper-secondary physics textbooks of South Korea, the United Kingdom, and Indonesia?
2) How is the distribution of basic inquiry skills in the physics textbooks of South Korea, the United Kingdom, and Indonesia?
3) How are integrated science process skills distributed in the physics textbooks of South Korea, the United Kingdom, and Indonesia?

Research Methodology

General Background

This study applied a descriptive qualitative research design. The summary, in the form of text, words, and short phrases, is labeled as data in the descriptive qualitative research design (Miles et al., 2014). The content analysis method used in this study analyzes the textbook documents in terms of text. Berelson (1952) has stated that, according to a certain coding rule, a methodical and reducing abundant text process into a smaller number of categories is outlined as a content analysis method. The objective of qualitative content analysis is to systematically reshape several words into a concise summary (Erlingsson & Brysiewicz, 2017). The inductive content analysis method is adopted to organize the content for descriptive purposes. In this study, inductive content analysis is adopted, which allows categories and themes to emerge naturally from the data rather than being predetermined. This is suitable for exploring new perspectives, particularly in understanding how digital experiments and science process skills are embedded in textbooks. Establishing the objectives as a foundation strategy for assessing qualitative data is mentioned as an inductive approach (Thomas, 2003). The framework established is used to interpret and categorize the results of the document analysis, which are presented in Tables 3 and 4. After developing the framework, the textbooks were coded according to the predefined categories and indicators for analysis, as shown in Figures 2,3, and 4. After the textbooks were coded, the trends that emerged within them were analyzed and classified depending on the framework that had been created.

The validity of this study was the theoretical framework foundation and expert validation. The creation of a framework based on the theoretical theories mentioned in the digital-related experiment framework, as presented in Tables 3 and 4. The framework was created with relevance to the other theories, literature, and research papers. Moreover, an expert in the field of physics education was invited to ensure the framework is valid for the analysis of the document using the content analysis research method. In this step, the researcher provided the framework in advance and reviewed it with the expert. The feedback given by the expert was used to assess the consistency of the created framework and the content analysis results. The validity of the fixed framework and the results of content analysis were then validated by the expert. Feedback from the expert helped identify unclear, redundant, and missing analysis indicators in the basic inquiry and integrated science process skills. This stage assisted in the comprehensive analysis of full physics textbooks. In this phase, it guided the consistency and accuracy of the framework's process-making, coding, and analysis content, which corresponds to a learning process conducted in the school. Using a combination of the theoretical framework and expert feedback, this research ensures its validity in finding the results.

Analysis Procedure

The document analysis procedure in this study is illustrated in Figure 1. The stages of data collection and document analysis were provided. The document analysis procedure started with preparing and collecting physics textbooks from South Korea, the United Kingdom, and Indonesia.

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
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Figure 1
Document Analysis Procedure

Step 1	Preparation	Preparing and collecting physics textbook documents from South Korea, the United Kingdom, and Indonesia.
	⇩	
Step 2	Review of physics textbooks documents	Once the physics textbooks' documents were prepared, the researchers reviewed them to identify the items that would be examined in this study. The item of digital-related experiment is analyzed, including basic inquiry skills and integrated science process skills within this experiment.
	⇩	
Step 3	Creating the theoretical framework	After reviewing the physics textbook document that includes digital-related experiments, the researchers identified and defined a theoretical framework based on references from other research papers. Researchers classified the framework into basic inquiry skills and integrated science process skills. As a result, this classification was decided and used as the foundational tool in this study, as shown in Tables 3 and 4.
	⇩	
Step 4	Document analysis	An analysis was conducted on the digital-related experiment within the upper-secondary physics textbooks documents of South Korea, the United Kingdom, and Indonesia, according to the theoretical framework developed in the previous stage.
	⇩	
Step 5	Data interpretation	After analyzing the documents, the results were compiled and interpreted.

Country Selection

The selection of physics textbooks was also based on the selection of countries referencing the science performance, which reflects the ability and skills in science. South Korea and the UK were chosen as developed countries with high science performance. At the same time, Indonesia represents a developing country with a lower PISA score, highlighting contrasts in science education approaches. This approach can show the gap differences in the use of digital tools in physics experiments between these countries. According to the PISA Result 2022, the countries were selected based on their science performance mean score, which is presented as follows.

Table 1
Country Selection

Countries	Mean Score	OECD score average	Countries classification
South Korea	528	Countries/economies with a mean performance/share of top performers above the OECD Average	Developed country (Eastern)
United Kingdom	500	Countries/economies with a mean performance/share of top performers above the OECD Average	Developed country (Western)
Indonesia	383	Countries/ economies with a mean performance/share of top performers below the OECD average	Developing country

**Note*: average OECD mean score in science is 485 points

According to Table 1, the data from the PISA 2022 results regarding the mean scores of science performance, as published by the OECD, were presented. The table illustrates that South Korea and the United Kingdom were among the countries with mean science scores above the OECD average, which is 485 points. Specifically, South

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Korea achieved a mean score of 528, making it one of the top-performing countries/economies in science. This score indicated a significantly higher proportion of top-performing students compared to the OECD average.

In comparison, the United Kingdom obtained 500 points as the mean score, which is slightly lower than South Korea, but is above the OECD average. South Korea was selected because, in Asia, it reached a high mean score in science, which was also a representation of the Eastern region. In comparison, the United Kingdom was selected as representative of the Western region, which also reached a high score of science performance. Furthermore, both South Korea and the United Kingdom were considered developed countries, which supports a comparison between the two regions with advanced educational infrastructures. Not only countries from developed countries, but also countries from developing countries, were chosen, each with a different education system. Indonesia was selected as a representative of a developing country. Since most Western countries were considered developed and generally had relatively high mean scores, while many Asian countries were below the OECD average, only one developing country, Indonesia, was selected for this study. According to the PISA 2022 results, Indonesia's science performance mean score was below the OECD average, positioning it as a case for analyzing how science education and inquiry skills are represented in developing countries.

Textbooks Designation

Physics textbooks for upper secondary were chosen in this study according to the level of students who started learning physics as a subject and the latest published textbooks. The selection of these six physics textbooks from South Korea, the United Kingdom, and Indonesia was conducted using purposive sampling. The selection of textbooks in this study was based on purposive sampling with the intention of capturing materials that are most representative of the national curriculum implementation in each country. Specifically, physics textbooks for upper-secondary) were chosen according to the grade level where physics is formally introduced as a distinct subject, and the most recent editions available to reflect current curriculum guidelines. In addition, the selected textbooks are those most commonly used in schools, making them representative of general classroom practice within each country. The textbooks used in this study are presented below.

Table 2
Physics Textbooks Designation

Country	Textbooks Title	Author	Publisher	Year	Age
South Korea	Upper-secondary Physics I	Son, J., Lee, B., Moon, H., Park, S., Lee, S., & Jeon, B.	Visang Education	2018	15-19
	Upper-secondary Physics II				
United Kingdom	Cambridge IGCSE Physics Fourth Edition	Kennett, H., & Duncan, T.	Hodder Education	2021	14-16
	Physics for Cambridge International AS & A Level Coursebook	Sang, D., Jones, G., Chadha, G., & Woodside, R.	Cambridge University Press	2022	16-19
Indonesia	Physics for Upper-secondary Grade 11	Radja wane, M. M., Itabuna, A., & Jono, S.	Ministry of Education, Culture, Research, and Technology	2022	16-18
	Physics for Upper-secondary Grade 12	Sarah, L. L., & Suwarmin, I. R.			

According to Table 2, the textbooks were selected based on the Upper-secondary grade, particularly the physics textbooks. The six physics textbooks were chosen randomly among many publishers. The physics textbooks that were analyzed from South Korea were 'Upper-secondary Physics I and II'. From the United Kingdom, 'Cambridge IGCSE Physics Fourth Edition' and 'Physics for Cambridge International AS & A Level Coursebook' were chosen. From Indonesia, the 'Physics for Upper-secondary Grade 11 and 12' was analyzed. The physics subject is generally taught at the Upper-secondary level, which was chosen as the object of analysis. At the high school Upper-secondary level, through physics subjects, basic inquiry, and integrated science process skills must be embedded.

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Digital-related Experiment Framework

The analytical framework in this study was compiled from various sources and references, including journal research, research institutes, and discussions among researchers who participated in this study. In this study, the distribution of basic inquiry and integrated science process skills within the digital-related experiment was analyzed. The framework in this study is divided into two parts involving basic inquiry and integrated science process skills. National Research Council (1996) has stated that basic inquiry skills have multifaceted activities that involve making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results. Fradd et al. (2015) have explained that basic inquiry skills include questioning, planning, implementing, concluding, and reporting. Basic inquiry skills contain skills including observation, classifying, measuring, calculation, using space/time relationships, communicating, inferring, and predicting (Sermsirikarnjana et al., 2017). Padilla (1986) has listed basic science process skills as observing, inferring, measuring, communicating, classifying, and predicting. Walters and Soyibo (2001) have given examples of basic inquiry skills, including observing, classifying, measuring, and predicting. According to these researchers, the analytical framework of basic inquiry skills was created as shown in Table 3.

Table 3
Indicators for Analyzing the Basic Inquiry Skills

Basic Inquiry Skills	Description	Indicators for analysis
Observing	Collecting data about information, objects, or phenomena through sensory perception	• Identifies the digital sensors, function, software, or simulations used in the experiment. • Recognizes changes in digital readouts (e.g., temperature, voltage, speed).
Questioning	Posing questions to explore phenomena, formulating hypotheses, and guiding the investigation	• Encouraging students to formulate questions based on observation regarding simulation or using digital experiment tools • Providing structured questions to guide students through experimentation using digital tools
Classifying	Categorizing items or events according to common characteristics	• While using digital tools, able to classify an object, data, or information related to the experiment (e.g., motion sensors). • Categorizes different types of objects or information using digital data (e.g., numerical vs. graphical).
Measuring	Determine length, volume, or mass using standard or non-standard units	• Uses digital measuring tools accurately (e.g., digital calipers, oscilloscopes). • Compares the precision of digital and analog measurements.
Inferring	Creating logical and reasonable conclusions from observed data	• Draws conclusions based on the data obtained from digital tools • Interprets errors or anomalies in sensor readings or other digital tools.
Predicting	Predicting future events based on patterns or previous experiences	• Uses simulation software to predict future outcomes in physics experiments. • Identifies patterns in real-time data shown in digital tools for making forecasts.
Communicating	Explaining results through words, graphs, or illustrations, and communicating with peers or teachers during the experiment	• Presents experimental results using digital graphs, charts, or reports (e.g., MS Excel, etc.). • Uses computer software to model and explain physics concepts.

Furthermore, according to Sermsirikarnjana et al. (2017), integrated scientific process skills contain skills such as formulating hypotheses, defining operationally, identifying and controlling variables, experimenting, interpreting data, and making inferences. Padilla (1986) has defined integrated science process skills as controlling variables, defining operationally, formulating hypotheses, interpreting data, experimenting, and formulating models. Integrated science skills were divided into identifying and defining variables, collecting and transforming data, constructing tables of data and graphs, describing relationships between variables, interpreting data, manipulating materials, formulating hypotheses, designing investigations, drawing conclusions, and generalizing (Walters & Soyibo, 2001). According to these researchers, the analytical framework of basic inquiry skills was created as shown in Table 4.

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

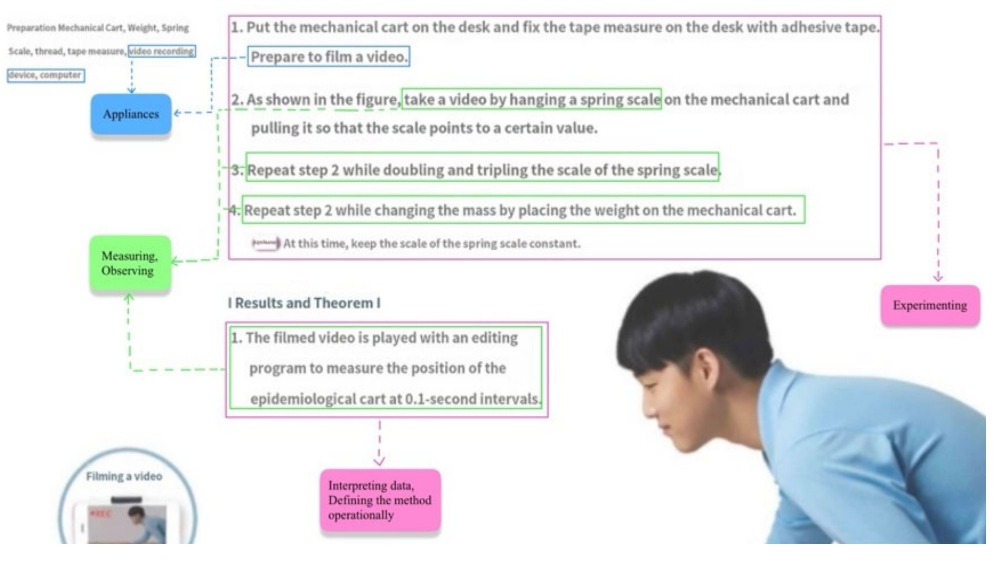
Table 4
Indicators for Analyzing the Integrated Science Process Skills

Integrated Science Process Skills	Description	Indicators for analysis
Identifying problems and variables	Recognizing problems and variables that influence the experiment results related to the utilization of digital tools	• Identifies problems in the experiment related to the utilization of digital tools • Defining independent, dependent, and controlled variables in digital-related experiments
Defining the method operationally	Defining the method for measuring a variable in an experiment	• Explains how digital tools (e.g., motion sensors, virtual lab software) measure variables like velocity, force, or temperature • Differentiates between direct sensor readings and computed values
Formulating hypotheses	Formulating and presenting hypotheses about the expected outcome of the experiment	• Predicts outcomes based on digital models or sensor data • Uses physics principles to justify expected trends in real-time digital data
Interpreting data	Arranging data and deriving conclusions	• Organizes the numerical, qualitative, or graphical data from digital tools • Analyzes trends and anomalies within simulations, digital tools, or sensor reading
Experimenting	Having the ability to conduct an experiment	• Designs or executes experiments utilizing digital tools (micro-based laboratory, etc.) • Ensures the accuracy of digital measurements and compares with theoretical calculations
Formulating model	Making a conceptual or physical model of phenomena or events.	• Creates computational models or simulations to represent physics concepts (e.g., motion, circuits, wave behavior). • Validates digital models by comparing simulated results with real-world data.

Document Analysis

Physics textbooks from South Korea, the United Kingdom, and Indonesia were analyzed using content analysis according to an established framework. In an experimental setting, the basic inquiry or integrated science process skills were counted as one skill if they emerged more than once. For instance, if the 'measuring' skills appear in steps 1,2, and 3, it was counted as one 'measuring' skill per experiment title. The example of the analysis of data from South Korean Physics Textbooks was taken from Upper-secondary Physics I. The title of the experiment is 'Relationship between Force, Work, and Acceleration Experiment'. An example analysis of this digital-related experiment is shown below.

Figure 2
Example Document Analysis for South Korea Physics Textbooks (Son et al., 2018)



https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Research Results

South Korea

According to the analysis data, the distribution of digital-related experiments within physics textbooks of South Korea is shown in Table 5.

Table 5
Digital-related Experiment Distribution in the South Korean Physics Textbooks

Appliances	Percentage (%)
Video recorder	37
Digital calipers	9
Sound level meter	9
Virtual (simulation) experiment	9
Digital voltmeter	9
MBL	9
Geomagnetic sensor	9
Digital ammeter	9

Based on Table 5, the video recorder demonstrated the highest usage percentage at 37%, reflecting its predominant role among the digital tools utilized. This was followed by digital calipers, sound level meters, virtual (simulation) experiments, digital voltmeter and ammeter, MBL, and geomagnetic sensor, each accounting for 9% of usage.

United Kingdom

According to the analysis data, the distribution of digital-related experiments within physics textbooks of the United Kingdom is shown in Table 6.

Table 6
Digital-related Experiment Distribution in the United Kingdom Physics Textbooks

Appliances	Percentage (%)
Computer	34
Digital timer	22
Digital ammeters	11
Digital voltmeter	11
Oscilloscope	22

Based on Table 6, the computer showed the highest usage percentage at 34%, followed by other digital tools such as the digital timer and oscilloscope, each accounting for 22%. The digital voltmeter and ammeter contributed 11% to the overall usage.

Indonesia

According to the analysis data, the distribution of digital-related experiments within physics textbooks of the United Kingdom is shown in Table 7.

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Table 7
Digital-Related Experiment Distribution in the Indonesian Physics Textbooks

Appliances	Percentage (%)
Virtual (simulation) experiment	67
Smartphone	17
Multimeter	12
Oscilloscope	4

Based on Table 7, the virtual (simulation) experiment recorded the highest usage percentage at 68%, followed by other digital tools such as the smartphone (16%), multimeter (12%), and oscilloscope, which contributed only 4%.

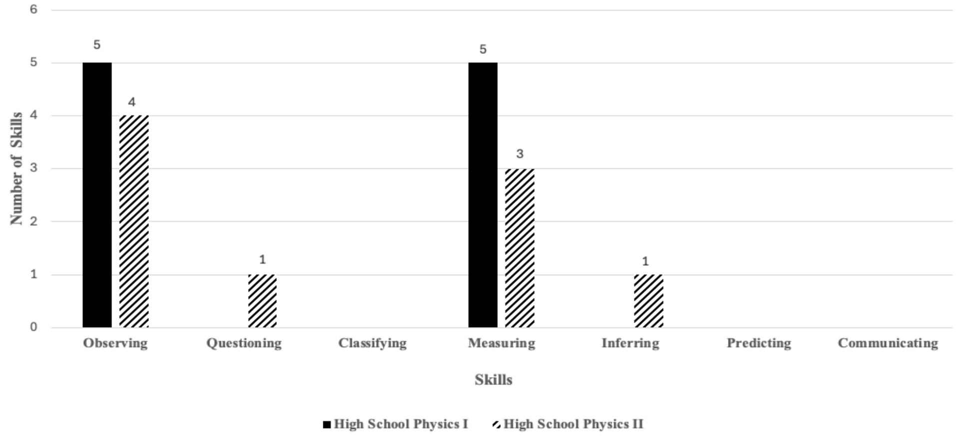
The Distribution of Basic Inquiry Skills in The Physics Textbooks

The distribution of basic inquiry skills in the physics textbooks from each country is shown below. This section highlights how these skills are integrated within the textbook's content.

South Korea

The distribution of basic inquiry skills in physics textbooks of South Korea is shown in Figure 3.

Figure 3
Distribution of Basic Inquiry Skills in the South Korean Physics Textbooks



According to Figure 3, which presents the distribution of basic inquiry skills in the physics textbooks of South Korea, the measuring and observing skills were the most prominent skills featured in Upper-secondary Physics I. In Upper-secondary Physics II, while measuring and observing skills remained present, the distribution of basic inquiry skills showed slight differences. Notably, two additional skills, questioning and inferring, were also incorporated.

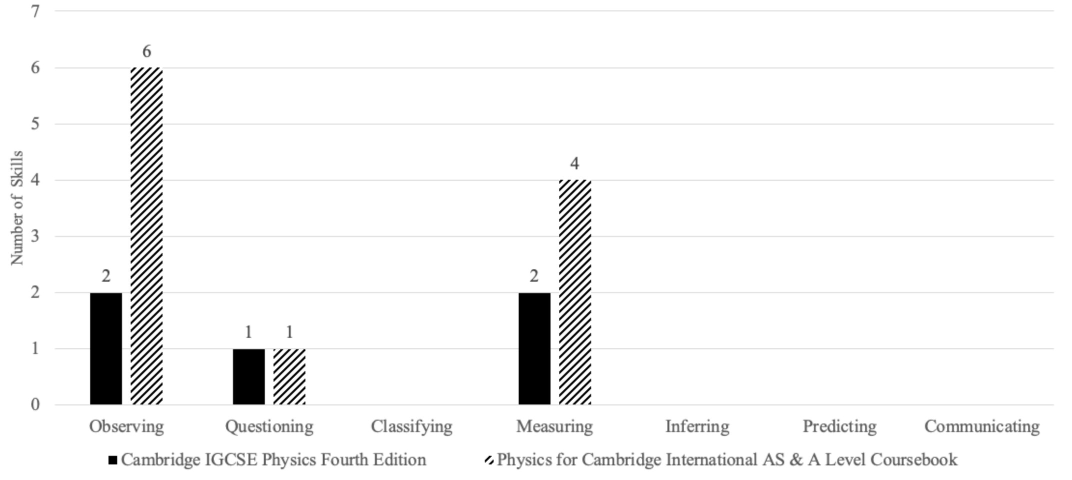
United Kingdom

The distribution of basic inquiry skills in physics textbooks of the United Kingdom is shown in Figure 4.

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648-3898 /Print/
ISSN 2538-7138 /Online/

Figure 4
Distribution of basic inquiry skills in the United Kingdom physics textbooks

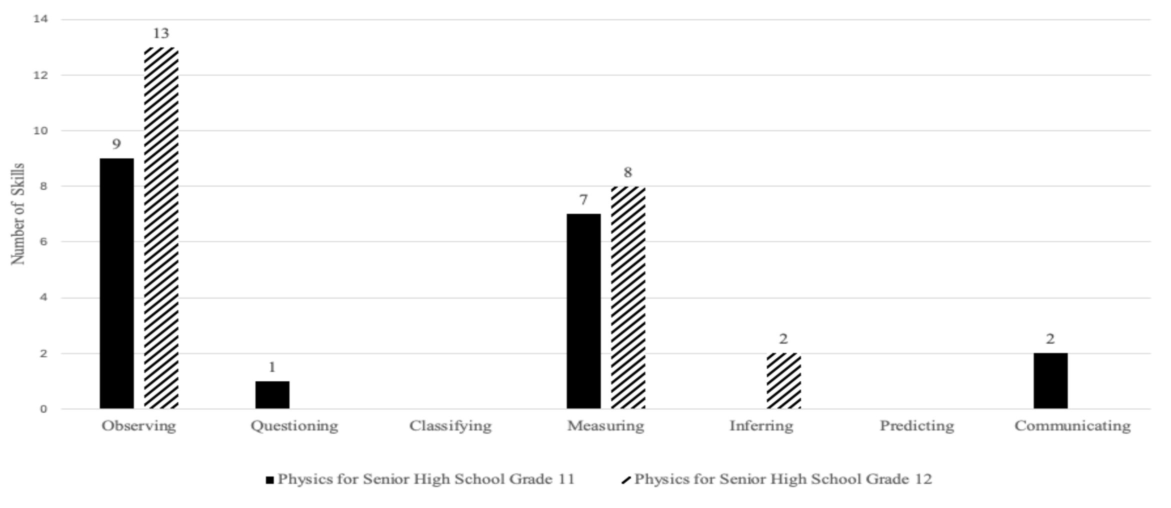


According to Figure 4, which presents the distribution of basic inquiry skills in the physics textbooks of the United Kingdom, the measuring and observing skills were the most prominent skills featured in Cambridge IGCSE Physics Fourth Edition. Physics for Cambridge International AS & A Level Coursebook, while measuring and observing skills remain present, the distribution of basic inquiry skills showed slight differences. Notably, one additional skill, questioning skills, was also incorporated into both textbooks.

Indonesia

According to the analysis data, the distribution of basic inquiry skills in the digital-related experiment within physics textbooks of Indonesia is shown in Figure 5.

Figure 5
Distribution of Basic Inquiry Skills in the Indonesian Physics Textbooks



According to Figure 5, which presents the distribution of basic inquiry skills in the physics textbooks of Indonesia, the measuring, observing, communicating, and questioning skills are featured in Physics for Upper-secondary Grade 11. Physics for Upper-secondary Grade 12, while measuring and observing skills remained pres-

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

ent, the distribution of basic inquiry skills showed slight differences. Notably, one additional skill, inferring skills, was also incorporated.

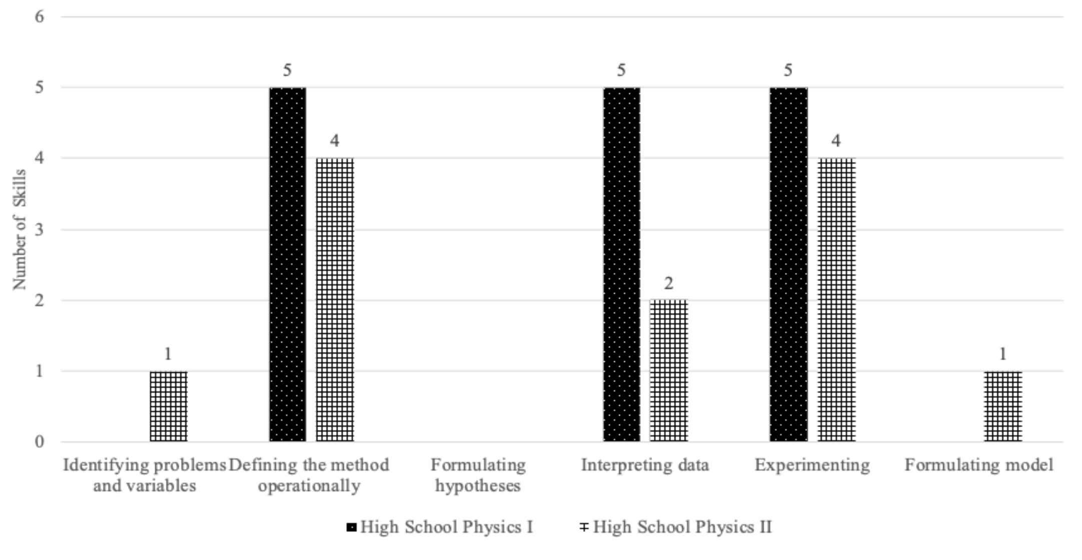
The Distribution of Integrated Science Process Skills in The Physics Textbooks

According to the analysis data, the distribution of integrated science process skills in the digital-related experiment within physics textbooks of each country is shown as follows.

South Korea

The distribution of integrated science process skills in physics textbooks of South Korea is shown in Figure 6.

Figure 6
Distribution of Integrated Science Process Skills in the South Korean Physics Textbooks



According to Figure 6, which presents the distribution of integrated science process skills in the physics textbooks of South Korea, defining operationally, interpreting data, and experimenting were the most prominent skills featured in Upper-secondary Physics I. In Upper-secondary Physics II, while defining operationally, interpreting data, and experimenting skills remained present, the distribution of integrated science process skills showed slight differences. Notably, two additional skills, identifying problems and variables, and formulating models, were also incorporated.

United Kingdom

The distribution of integrated science process skills in physics textbooks of the United Kingdom is shown in Figure 7.

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
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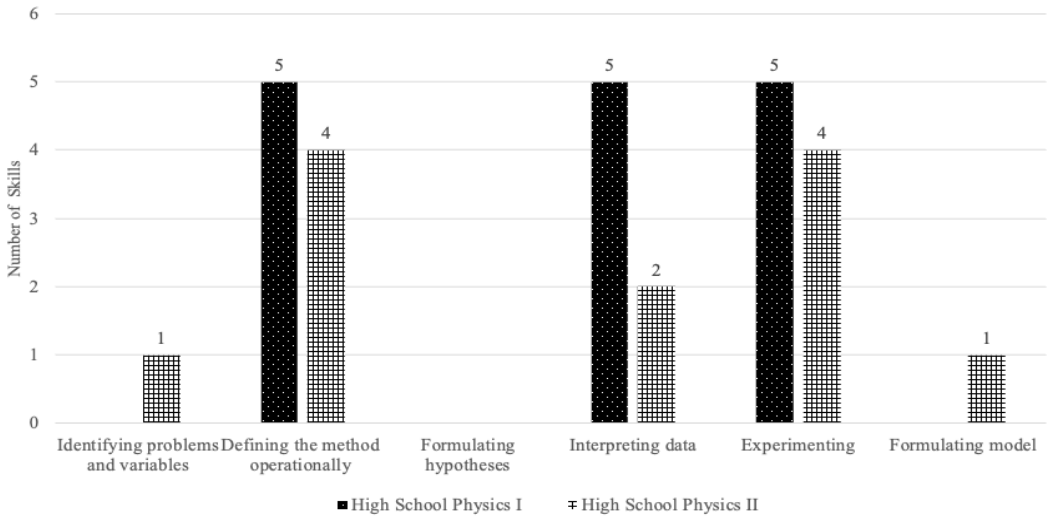
Figure 7
Distribution of Integrated Science Process Skills in the United Kingdom Physics Textbooks

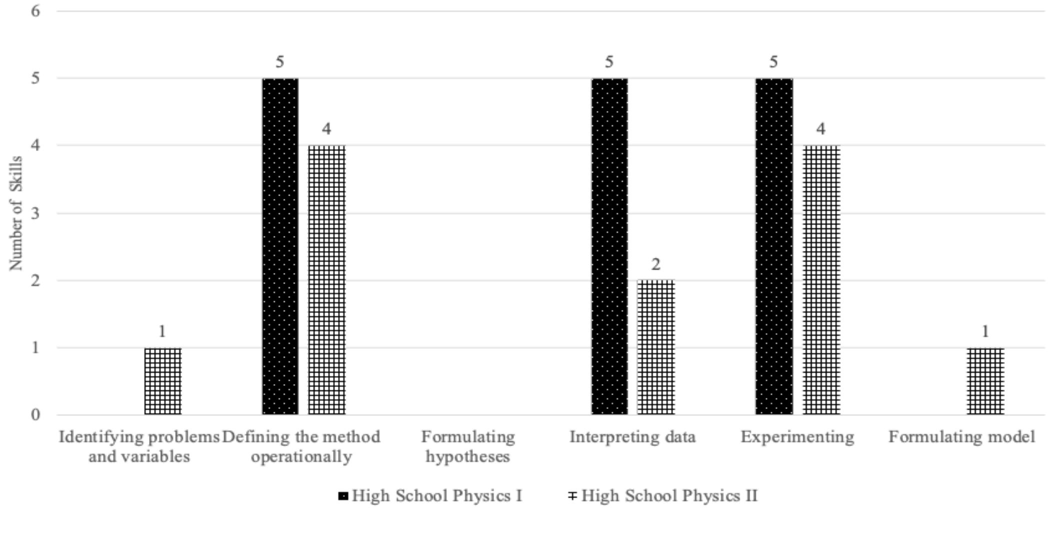


According to Figure 7, which presents the distribution of integrated science process skills in the physics textbooks of the United Kingdom, defining operationally, experimenting, and identifying problems and variable skills were the most prominent skills featured in the Cambridge IGCSE Physics Fourth Edition and Physics for Cambridge International AS & A Level Coursebook. Notably, only two skills, defining operationally and experimenting, were incorporated in Cambridge IGCSE Physics Fourth Edition.

Indonesia

According to the analysis data, the distribution of integrated science process skills in digital-related experiments within physics textbooks of Indonesia is shown in Figure 8.

Figure 8
Distribution of Integrated Science Process Skills in the United Kingdom Physics Textbooks



https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

According to Figure 8, which presents the distribution of integrated science process skills in the physics textbooks of Indonesia, the defining operational and experimenting skills were the most prominent featured in Physics for Upper-secondary Grade 11. In Physics for Upper-secondary Grade 12, while defining operational and experimenting skills remained present, the distribution of integrated science process skills shows various skills, including identifying problems and variables; interpreting data; and formulating models.

The distribution of basic inquiry skills and integrated science process skills in South Korea, the United Kingdom, and Indonesia is shown in Figures 9 and 10.

Basic Inquiry Skills

The distribution of basic inquiry skills in South Korea, the United Kingdom, and Indonesia is shown in Figure 9.

Figure 9
Distribution of Basic Inquiry Skills in South Korea, the United Kingdom, and Indonesia Physics Textbooks

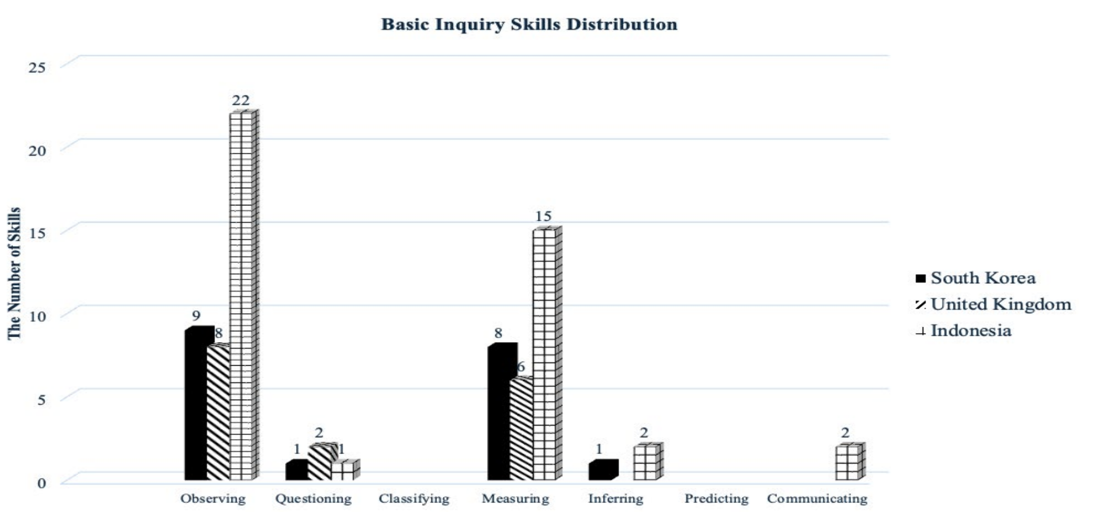


Figure 9 shows the distribution of basic inquiry skills in South Korea, the United Kingdom, and Indonesia. According to the data, the total number of all basic inquiry skills within physics textbooks of these three countries was 77 skills. The most prevalent basic inquiry skill found in digital-related experiments was observing. Observing skills reached the highest number of skills with a total of 39 instances identified across the three countries. Indonesia had the highest number with 22 observing skills, followed by South Korea with 9 skills, and the United Kingdom with 8 skills found in the physics textbooks. The second most frequently appearing skill was measuring, with a total of 29 skills across all three countries. Similarly, Indonesia led with 15 measuring skills, followed by South Korea with eight skills, and the United Kingdom with six skills. The third position was occupied by questioning skills, with a total of four skills across the three countries. The United Kingdom contributed two skills, while Indonesia and South Korea each contributed only one skill. Inferring skills were ranked fourth, with a total of three instances being identified exclusively in the textbooks from South Korea and Indonesia; no such skills were identified in the physics textbooks from the United Kingdom. The fifth position was communicating skills, with only two skills, both of which appear in Indonesian physics textbooks. Communicating skills were not found in the physics textbooks from South Korea or the United Kingdom. Lastly, classifying and predicting skills did not appear at all in the textbooks from any of the three countries.

Integrated Science Process Skills

The distribution of integrated science process skills in South Korea, the United Kingdom, and Indonesia is shown in Figure 10.

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Figure 10
Distribution of Integrated Science Process Skills in South Korea, the United Kingdom, and Indonesia Physics Textbooks

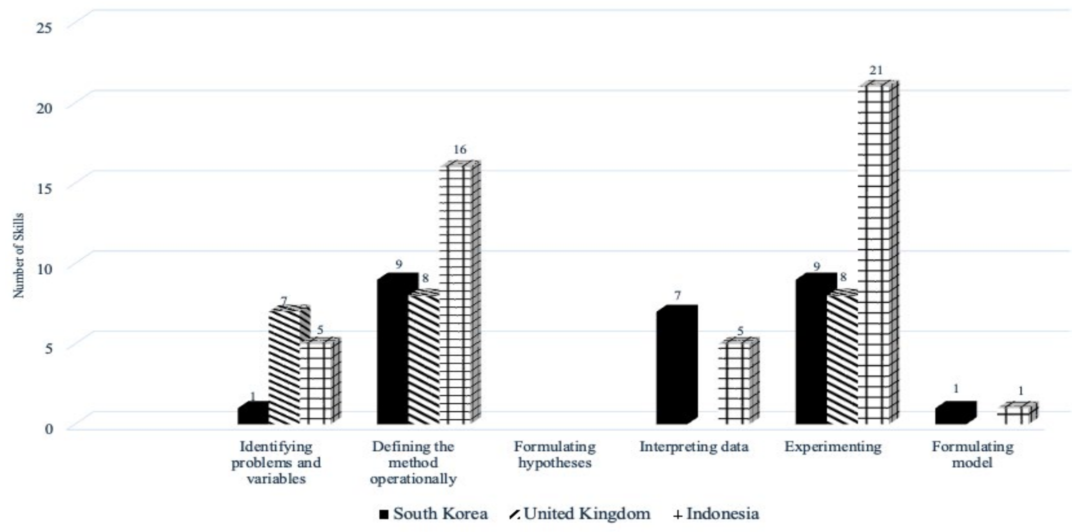


Figure 10 shows the distribution of integrated science process skills in South Korea, the United Kingdom, and Indonesia. According to the data, the total number of all integrated science process skills within physics textbooks of these three countries was 98 skills. The most frequently occurring integrated science process skill in digital-related experiments was experimenting. Experimenting skills reached the top skills, with a total of 38 skills identified across the three countries. Indonesia contributed the highest number with 21 experimenting skills, followed by South Korea with 9 skills, and the United Kingdom with 8 skills, as found in each physics textbook. The second most prevalent skill was defining the method operationally, with a total of 33 skills across the three countries. Indonesia reached with16 skills, followed by South Korea with 9 skills, and the United Kingdom with 8 skills. In third place was the skill of identifying problems and variables, which appears 13 skills in total. The United Kingdom contributed 7 skills, Indonesia had 5 skills, and South Korea had one skill. The fourth position was occupied by interpreting data, with 12 skills in total. Seven skills from South Korea and 5 from Indonesia, while this skill did not appear in textbooks from the United Kingdom. The fifth position was held by formulating models with only two skills in total, each from Indonesia and South Korea. These skills were not found in the United Kingdom physics textbooks. Lastly, the skill of formulating hypotheses did not appear at all in the physics textbooks from any of the three countries.

While Figures 9 and 10 highlight the frequency of basic inquiry and integrated science process skills in digital-related experiments, a deeper examination reveals differences in how these skills are embedded and scaffolded within the instructional design of each country's textbooks. In Indonesian textbooks, frequently appearing skills such as observing, measuring, and experimenting are often presented through direct, procedural instructions with limited progression in complexity. In contrast, South Korean textbooks, although lower in frequency, show signs of better scaffolding, particularly in skills such as interpreting data and defining methods operationally, where students are guided through increasingly complex tasks. UK textbooks, while featuring fewer total skill instances, often integrate skills such as questioning and identifying variables within contextualized, inquiry-based learning activities. This approach indicates a stronger alignment with scientific reasoning. However, across all three countries, the absence of certain higher-order skills, such as formulating hypotheses or predicting, and the limited use of communication and modeling, suggest a gap in the comprehensive development of scientific inquiry.

Discussion

According to the results, the utilization of digital-related experiments in these physics textbooks in each country aligns with the goal of Science-Technology-Society (STS) education. In South Korean physics textbooks, the most digital-related experiment that is used is a video recorder. The remaining digital tools are used, including digital calipers, sound level meter, virtual (simulation) experiment, digital voltmeter, MBL, and geomagnetic sensor. Moreover, in the United Kingdom, the most digital-related experiment used in physics textbooks is a computer. The

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

remaining digital tools are used, including digital timers, oscilloscopes, digital voltmeters, and digital ammeters. Furthermore, in Indonesian physics textbooks, the most digital-related experiment that is used is a virtual (simulation) experiment. The remaining digital tools are used, including a smartphone, multimeter, and oscilloscope. The implementation of digital-related experiments in each country appears to be influenced by the availability of educational tools and resources. In South Korea, the digital-related experiment that was dominant was the video recorders, which assist students in collecting precise measurement data during experiment activities. At the same time, hands-on experiments were also presented. Similarly, in the United Kingdom, the computer device was dominantly utilized to support long-duration experiments, which also supports the accuracy of data analysis. The balanced integration of digital-related and hands-on experiments observed in South Korea and the United Kingdom may reflect a more comprehensive approach to experimental science education. Such an approach can play a critical role in fostering students' scientific inquiry skills and conceptual understanding. In contrast, in Indonesia, limited access to physical experiment tools has resulted in an overreliance on virtual simulations. This lack of diverse experimental opportunities may have constrained the development of students' science process skills and limited their engagement in inquiry-based learning. Nevertheless, both South Korea and the United Kingdom present high-quality hands-on experiments, which result in the limited utilization of digital-related experiment tools. In contrast, Indonesia displays many virtual simulations because of the limited physical laboratory tools. This suggests that digital-related experiments in Indonesia were complementary tools to guide the student in the learning process, as a consequence of the absence of comprehensive hands-on experimental equipment. Hodson (2020) has argued that the goal of STS education is to see the students utilize technology as real-world experiences and increase awareness of an issue that aims to improve science learning. Gardner (1999) has also argued that the decisions or ideas that students form regarding science and technology, as well as their relationship, affect their decision-making for their future lives and careers, or determine their expertise in their future education. Walan (2020) has declared that digital technology helps the teacher visualize abstract scientific phenomena and engage students in a meaningful study. Chen (2017) has found that digitized textbooks affected student engagement, including the senses of vision and touch in science learning.

The distribution of basic inquiry skills in the digital-related elements of physics textbooks from South Korea, the United Kingdom, and Indonesia predominantly emphasizes observing and measuring skills, while other skills are only minimally incorporated. The need for integrating basic inquiry skills into digital-related experiments and incorporating a broader range of such skills is necessary. The distribution of basic inquiry skills in digital-related experiments in physics textbooks from South Korea, the United Kingdom, and Indonesia, which are incorporated within the textbooks, mostly involves observing skills. Measuring skills also became the second prevalent skill, followed by questioning skills. In the case of inferring and communicating skills, only one to two countries are provided within their textbooks. In contrast, the skills of classifying and predicting skills were not provided in the physics textbooks of three countries. Jong et al. (2013) have argued that the combination of virtual and physical design, with a well-designed, assists students in obtaining a more complex understanding of scientific phenomena and developing inquiry skills. Ješková et al. (2018) have explained that in the process of learning science, particularly physics, students should gain not only scientific knowledge but also skills to inquire to understand how scientists work. Wang et al. (2015) have found that model-based inquiry in physics virtual lab pedagogy, introducing the virtual experiment design and analysis, can give a deep practice of science process skills, comprehensive and reflection skills of scientific inquiry.

The distribution of integrated science process skills in digital-related experiments from South Korea, the United Kingdom, and Indonesia that are incorporated within the physics textbooks are mostly experimenting skills, while the other skills are only minimally incorporated. Embedding integrated science process skills in digital-related experiments within physics textbooks is essential. Defining the method operationally skills also become the second prevalent skill, followed by identifying problems and variables. In the case of interpreting data dan formulating models, only two countries provided the skills within physics textbooks. In contrast, the formulating hypotheses skill was not provided within the physics textbooks of the three countries. Kuriniawati (2021) has stated that science process skills, which covered basic and integrated process skills, were closely related to science learning. Saat (2004) has found that the analysis of children's cognitive behaviors provides some insight concerning cognitive skills instruction and the integrated science process skills acquisition in the web-based learning environment. This supports the notion that the integrated science process skills in digital-related experiments contribute to the development of students' cognitive skills. El-Sabagh (2011) has found that web-based virtual labs provided considerable support for students and helped them to improve their conceptual understanding of science and science process skills.

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Conclusions and Implications

This study analyzed and compared the distribution of digital-related experiments, basic inquiry skills, and integrated science process skills within upper-secondary physics textbooks in South Korea, the United Kingdom, and Indonesia. The purpose of this study is to analyze and compare the basic inquiry and integrated science process skills in digital-related experiments within physics textbooks of South Korea, the United Kingdom, and Indonesia.

The results obtained from the distribution of digital-related experiments in South Korean physics textbooks show that the most commonly used digital-related experiment is a video recorder. In the United Kingdom, in physics textbooks, the most digital-related experiment that is used is a computer. In Indonesian physics textbooks, the most digital-related experiment that is used is a virtual (simulation) experiment. Moreover, the distribution of basic inquiry skills in the digital-related elements of physics textbooks from South Korea, the United Kingdom, and Indonesia predominantly emphasizes observing and measuring skills, while other skills are only minimally incorporated. Each country has quite a different distribution of basic inquiry skills. However, the classifying and predicting were not found in any textbooks. Furthermore, the distribution of integrated science process skills in digital-related experiments from South Korea, the United Kingdom, and Indonesia, which are incorporated into the physics textbooks, are mostly experimenting skills, while the other skills are only minimally incorporated. The integrated science process skills are distributed differently across these countries. However, formulating hypotheses was not found in any textbooks.

This study strongly emphasizes the digital-based experiments, which highlight the optimization of basic inquiry and integrated science process skills distribution. These science process skills are not only used during hands-on experiments but also when using digital-related experiments. Although modern technological tools are embedded in physics textbooks to enhance learning effectiveness, it is essential that their use also promotes the balanced development and assessment of all science process skills at the upper-secondary level. According to Piaget's theory of cognitive development, upper-secondary students are generally in the formal operational stage, a phase characterized by the ability to think abstractly, reason logically, and engage in systematic problem-solving. At this developmental stage, students are not only capable of learning and applying basic inquiry skills but are also developmentally prepared to engage with more complex, integrated science process skills. The materials provided at the upper-secondary level generally foster the foundational and advanced scientific process, thinking, and skills. These abilities are essential for engaging students in scientific inquiry and understanding. The results of this study show that most digital-related experiments focused on observing and measuring skills within the experiments, without formulating hypotheses based on the digital tools used. For example, in South Korean physics textbooks, the most used digital-related experiment involves using a video recorder to record the motion of a wooden block. In United Kingdom physics textbooks, the most used digital-related experiment involves connecting a computer to a motion sensor as an alternative to a stopwatch to measure the period of a pendulum. In Indonesian physics textbooks, the most used digital-related experiment is a virtual (simulation) experiment used to determine the magnitude of the Coulomb force. Most of these tools were used because they are effective for observation and data collection, but they are less effective in fostering the formulation of hypotheses. For instance, one potential improvement could be to provide a guide on the utilization of digital tools, outlining how predictions or hypotheses could be formed based on the expected outcomes in experiments when using digital-related tools.

Furthermore, this study can be used as a reference in developing educational policy or curriculum on a global scale. It provided insight into how different countries and cultures embedded digital-related experiments in their physics textbooks at the upper-secondary level. This research can give information to the policymakers and curriculum developers about what type or trend is the best to improve the digital-related experiment implementation. It encourages the authorities of the education field to update or improve the integration of digital technology within textbooks, curricula, or educational policy. While some general implications, such as the importance of aligning textbook content with science process skills, can be applied broadly, specific implementation strategies may vary across countries due to differences in curriculum standards, teacher training systems, and digital infrastructure. An effective starting point for implementation could be professional development programs that train teachers to identify and integrate science process skills into digital-related experiments. Additionally, textbook developers could be guided to align activities more explicitly with the national learning objectives of each country. Some science process skills may be more effectively taught through specific topics. For example, 'hypothesis formulation' may be better integrated in inquiry-based electricity experiments, while 'data interpretation' may be stronger in topics like motion and forces. This is an area worth exploring further and could form the basis for future analysis.

https://doi.org/10.33225/jbse/25.24.860

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

Acknowledgments

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2024S1A5A8027730).

Declaration of Interest

The authors declare no competing interest.

References

Aboagye, G. K., Anto, T. A., & Ampiah, J. G. (2018). Combining inquiry-based hands-on and simulation methods with cooperative learning on students' learning outcomes in electric circuits. *American Journal of Educational Research*, *6*(8), 1172–1181. https://pubs.sciepub.com/education/6/8/16/index.html

Banda, H., J., & Nzabahimana, J. (2023). The impact of physics education technology (PhET) interactive simulation-based learning on motivation and academic achievement among Malawian physics students. *Journal of Science Education and Technology*, *32*, 127–141. https://doi.org/10.1007/s10956-022-10010-3

Berelson, B. (1952). *Content analysis in communication research*. Free Press.

Chen, X. (2017). A comparative study of visual representations in conventional, digitized, and interactive high school science textbooks. *Journal of Visual Literacy*, *36*(2), 104–122. http://dx.doi.org/10.1080/1051144X.2017.1386388

Chiappetta, E. L., & Koballa, T. R. (2010). *Science instruction in the middle and secondary schools*. Pearson Merrill Prentice Hall.

Emejulu, A., & McGregor, C. (2016). Towards a radical digital citizenship in digital education. *Critical Studies in Education*, *60*(1), 131–147. https://10.1080/17508487.2016.1234494

Erlingsson, C., & Brysiewicz, P. (2017). A hands-on guide to doing content analysis. *African Journal of Emergency Medicine*, *7*, 93–99. http://dx.doi.org/10.1016/j.afjem.2017.08.001

Finkelstein, N. D., Adams, W. K., Keller, C. J., Kohl, P. B., Perkins, K. K., Podolefsky, N. S., & Reid, S. (2005). When learning about the real world is better done virtually: A study of substituting computer simulations for laboratory equipment. *Physics Education Research*, *1*, Article 010103. https://doi.org/10.1103/PhysRevSTPER.1.010103

Fradd, S. H., Lee, O., Sutman, F. X., & Saxton, K. (2015). Promoting science literacy with English language learners through instructional materials development: A case study. *The Journal of the National Association for Bilingual Education*, *25*(4), 479–50. http://dx.doi.org/10.1080/15235882.2001.11074464

Gardner, P. L. (1999). The representation of science-technology relationships in Canadian physics textbooks. *International Journal of Science Education*, *21*(3), 329–347. http://dx.doi.org/10.1080/095006999290732

Ghory, S., & Ghafory, H. (2021). The impact of modern technology in the teaching and learning process. *International Journal of Innovative Research and Scientific Studies*, *4*(3), 168–173. https://doi.org/10.53894/ijirss.v4i3.73

Harlen, W. (1999). Purposes and procedures for assessing science process skills. *Assessment in Education: Principles, Policy & Practice*, *6*(1), 129–144. https://doi.org/10.1080/09695949993044

Hochberg, K., Kuhn, J., Müller, A. (2018). Using smartphones as experimental tools—Effects on interest, curiosity, and learning in physics education. *Journal of Science Education and Technology*, *27*, 385–403. https://doi.org/10.1007/s10956-018-9731-7

Hodson, D. (2020). Going beyond STS Education: Building a curriculum for sociopolitical activism. *Canadian Journal of Science, Mathematics and Technology Education*, *20*, 592–622. https://doi.org/10.1007/s42330-020-00114-6

Huang, R., Tlili, A., Zhang, X., Sun, T., Wang, J., Sharma, R. C., Affouneh, S., Salha, S., Altinay, F., Altinay, Z., Olivier, J., Jemni, M., Wang, Y., Zhao, J., & Burgos, D. (2022). A comprehensive framework for comparing textbooks: Insights from the literature and experts. *Sustainability*, *14*, Article 6940. https:// doi.org/10.3390/su14116940

Ješková, Z., Balogová, B., & Kireš, M. (2018). Assessing inquiry skills of upper secondary school students. *Journal of Physics: IOP Conference Series*, *1076*, Article 012022. https://iopscience.iop.org/article/10.1088/1742-6596/1076/1/012022

Jong, T., Linn, M. C., & Zacharia, Z. C. (2013). Physical and virtual laboratories in science and engineering education. *Science*, *30*(6130), 305–308. https://www.science.org/doi/10.1126/science.1230579

Kennett, H., & Duncan, T. (2021). Cambridge IGCSE physics fourth edition. Hodder Education.

Kluge, A. (2014). Combining laboratory experiments with digital tools to do scientific inquiry. *International Journal of Science Education*, *36*(13), 2157–2179. http://dx.doi.org/10.1080/09500693.2014.91645

Kruppke, B. (2021). Experiments in higher education-A "how to: and "how it went" for an interactive experiment lecture on dental materials. *Education Sciences*, *11*, Article 190. https://doi.org/10.3390/educsci11040190

Kumar, D., D., & Chubin, D. E. (2000). *Innovation in science education and technology science, technology, and society: A sourcebook on research and practice*. Springer Science+Business Media Newyork.

Kurniawati, A. (2021). Science process skills and their implementation in the process of science learning evaluation in schools. *Journal of Science Education Research*, *5*(2), Article 16. www.journal.uny.ac.id/jser

Lahme, S. Z., Klein, P., Lehtinen, A., Müller, A., Pirinen, P., Rončević, L., & Sušac, A. (2023). Physics lab courses under digital transformation: A trinational survey among university lab instructors about the role of new digital technologies and learning objectives. *Physical Review Physics Education Research*, *19*, Article 020159. https://doi.org/10.1103/PhysRevPhysEducRes.19.020159

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). *Qualitative data analysis a methods sourcebook edition 3*. SAGE Publications.

ISSN 1648–3898 /Print/
ISSN 2538–7138 /Online/

National Research Council. (2000). *National science education standards*. The National Academies Press. https://doi.org/10.17226/4962

Organisation for Economic Co-operation and Development (OECD). (2022). *PISA 2022 results of the state of learning and equity in education volume I*. OECD Publishing. https://www.oecd.org/en/publications/pisa-2022-results-volume-i_53f23881-en.html

Padilla, M. J. (1986). *The science process skills*. National Association for Research in Science Teaching. https://eric.ed.gov/?id=ED266961

Radjawane, M. M., Itabuna, A., & Jono, S. (2022). *Physics for senior high school grade 11*. Ministry of Education, Culture, Research, and Technology.

Roch, M. R., & Martina, M. (2022). VirtLAB: A low-cost platform for electronics lab experiments. *Sensors*, *22*(13), Article 4840. https://doi.org/10.3390/s22134840

Ronen, M., & Eliahu, M. (2001). Simulation—a bridge between theory and reality: The case of electric circuits. *Journal of Computer Assisted Learning*, *16*(1), 14–26. https://doi.org/10.1046/j.1365-2729.2000.00112.x

Saat, R. M. (2004). The acquisition of integrated science process skills in a web-based learning environment. *Research in Science & Technological Education*, *22*(1), 23–40. http://dx.doi.org/10.1080/0263514042000187520

Sang, D., Jones, G., Chadha, G., & Woodside, R. (2022). *Physics for Cambridge International AS & A Level coursebook*. Cambridge University Press.

Sarah, L. L., & Suwarmin, I. R. (2022). Physics for senior high school grade 12. Ministry of Education, Culture, Research, and Technology.

Sermsirikarnjana, P., Kiddee, K., & Phadungchai. (2017). An integrated science process skills needs assessment analysis for Thai vocational students and teachers. *Asia-Pacific Forum on Science Learning and Teaching*, *18*(2), 1. https://www.eduhk.hk/apfslt/download/v18_issue2_files/pongsuwat.pdf

Son, J., Lee, B., Moon, H., Park, S., Lee, S., & Jeon, B. (2018). *High school physics I*. Visang Education.

Son, J., Lee, B., Moon, H., Park, S., Lee, S., & Jeon, B. (2018). *High school physics II*. Visang Education.

Thomas, D. R. (2003). *A general inductive approach for qualitative data analysis*. School of Population Health University of Auckland.

Thornton, R. K. (1992). Tools for scientific thinking: Learning physical concepts with real-time laboratory measurement tools. *NATO ASI Series*, *96*. https://doi.org/10.1007/978-3-642-77750-9_12

Wagner, C. S., Brahmakulam, I., Jackson, B., Wong, A., & Yoda, T. (2001). *Science and technology collaboration: Building capacity in developing countries*. RAND.

Walan, S. (2020). Embracing digital technology in science classrooms—secondary school teachers' enacted teaching and reflections on practice. *Journal of Science Education and Technology*, *29*, 431–44. https://doi.org/10.1007/s10956-020-09828-6

Wang, J., Guo, D., & Jou, M. (2015). A study on the effects of model-based inquiry pedagogy on students' inquiry skills in a virtual physics lab. *Computers in Human Behavior*, *49*, 658–669. http://dx.doi.org/10.1016/j.chb.2015.01.043

Received: *July 10, 2025* Revised: *August 06, 2025* Accepted: *September 12, 2025*

Cite as: Dewi, N. W. R. U., & Kim, M. (2025). Basic inquiry and integrated science process skills in digital-related experiments within physics textbooks of South Korea, the United Kingdom, and Indonesia. *Journal of Baltic Science Education*, *24*(5), 860–877. https://doi.org/10.33225/jbse/25.24.860

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